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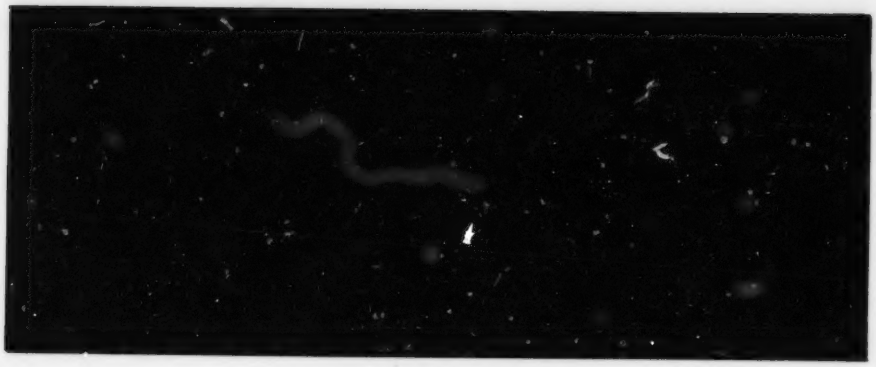

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Technical/Final Report
to
Saskatchewan Agriculture Development Fund

Improvement of Sow Fertility

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Final ADF
~~PROGRESS~~ REPORT

IMPROVEMENT OF SOW FERTILITY

P.A. Thacker
Dept of Animal Science
University of Saskatchewan
Saskatoon, Saskatchewan
S7N 0W0

A. EXECUTIVE SUMMARY

1. Abstract

This study evaluated two methods of reducing preweaning mortality in baby pigs; the use of the Medata Blowaway Unit and somatostatin immunization. The results of this study indicate that use of a Blowaway Unit is an effective method of reducing crushing losses but must be used in conjunction with other management techniques if total preweaning mortality is to be decreased. However, additional developmental research is needed before somatostatin immunization will have a place in commercial swine production.

2. Summary

A total of 69 litters from crossbred sows (Large White x Landrace) of mixed parity were used to evaluate the effectiveness of a farrowing crate attachment (Medata Blowaway Unit) designed to reduce baby pig mortality by directing an air stream directly under the standing sow. Use of this attachment was hypothesized to condition piglets to avoid the area under the standing sow and thereby reduce their chances of being crushed if the sow moved. All sows received the same treatment during the experiment except that a Blowaway Unit was attached to half of their farrowing crates a minimum of three days before parturition and remained there until ten days post partum. Sows farrowing in crates fitted with a Blowaway Unit crushed significantly ($P<0.05$) fewer of the total number of piglets born alive than did sows farrowing in crates without a Blowaway Unit (5.3 vs 2.3%). However, mortality occurring as a result of starvation and other miscellaneous causes was slightly higher for sows farrowing with a Blowaway Unit than without (11.5 vs 10.6%). Therefore, under the conditions of this experiment, preweaning mortality was not significantly reduced by using a Blowaway attachment.

The initial objective of the second study was to determine the effectiveness of somatostatin immunization as a means of reducing preweaning mortality in baby pigs. However, before conducting this experiment, it was necessary to conduct a preliminary experiment in order to determine the proper adjuvant to allow the development of an adequate immune response.

Twenty weanling pigs were used in a preliminary study to compare the usefulness of four different adjuvants for use in the immunization of swine against somatostatin. The adjuvants tested were Havlogen, Freunds Complete Adjuvant, the Ribi Adjuvant System consisting of Trehalose Dimycolate and Monophosphoryl Lipid A and finally Regressin, a bacterial cell wall constituent. Pigs were immunized with a somatostatin-ovalbumin conjugate (50 ug somatostatin equivalent) at a weight of 30 kg and boosted two weeks later. Blood samples were then taken every two weeks.

No antibody titers were detectable in pigs receiving the control treatment. Freunds Complete Adjuvant induced a very strong immune response, whereas the Havlogen, Ribi and Regressin treatments resulted in relatively low titres. However, Freunds Complete Adjuvant produces a tuberculin positive test at slaughter and therefore cannot be used in food producing animals. Therefore, none of the adjuvants tested were suitable for our use and we were therefore unable to complete the experiment testing somatostatin immunization as a means of reducing preweaning mortality in baby pigs. Further developmental work is therefore required before commercial application of somatostatin immunization in animal production can be attempted.

B. TECHNICAL REPORTS

1. Use of Planned Drafts in an Attempt to Reduce Preweaning mortality in baby pigs.

2. Immunization of Swine Against Somatostatin.

USE OF PLANNED DRAFTS IN AN ATTEMPT TO REDUCE PREWEANING MORTALITY IN BABY PIGS

P.A. Thacker and E.M. Barber

INTRODUCTION

One of the most important factors determining the overall profitability of a farrow to finish swine operation is the number of pigs weaned per sow per year. The number of pigs weaned per sow is a function of the size and number of litters farrowed per year and both must be maximized if the full reproductive potential of the sow is to be realized. The number of litters per sow can be increased by improving conception rates, shortening the farrowing interval and implementing an earlier weaning regime. Litter size can be increased by crossbreeding, hand mating, double mating and maintaining a high ratio of sows to gilts in the herd. However, most producers will obtain the greatest increase in the number of pigs weaned per sow per year by reducing the incidence of preweaning mortality.

Recent surveys conducted in Canada and the United States indicate that an average of 20-25% of all pigs farrowed, die before weaning. Most of these losses result from crushing by the sow, chilling, starvation, weakness or disease. In contrast, some production units have a preweaning mortality as low as 10%. This indicates that it may be possible to save as many as one pig per litter through improvements in facilities and management. Therefore, any piece of equipment that can reduce preweaning mortality is likely to receive considerable commercial interest.

OBJECTIVES

A farrowing crate attachment has been developed recently in the United Kingdom which is reported to reduce baby pig mortality occurring as a result of crushing by the sow. The purpose of this experiment was to evaluate this attachment to determine its effectiveness under commercial conditions on the Canadian Prairies.

EXPERIMENTAL PLAN

Sows were randomly assigned before parturition to one of two treatments. Sows in the experimental group received the same treatment as sows in the control group except that a Medata Blowaway Unit was attached to their farrowing crate a minimum of three days before parturition, remaining there until ten days post-partum.

The Blowaway unit (Figure 1) contains an infra-red sensing device which sends a beam of light across the width of the farrowing crate. The beam is adjusted so that it passes just above the sow's back when she is lying down. As soon as the sow stands, the beam is broken, activating a switch on the blower of a 50 Watt motor. An air stream is directed under the sow's body, causing the piglets to retreat to the creep area. The air stream is automatically switched off when the sow lies down and the piglets return to suckle.

A total of 69 litters from crossbred sows (Large White x Landrace) of mixed parity were tested during this experiment. During gestation, sows were housed individually in gestation stalls and received between 1.8 and 2.7 kg of feed per day depending on their condition. The gestation ration was formulated to contain 15% crude protein, 0.9% calcium, 0.7% phosphorus and sufficient other vitamins and minerals to meet or exceed NRC recommendations. The formulation of the gestation ration is presented in Table 1.

At day 109 of gestation, sows were moved into farrowing crates located in an environmentally controlled room maintained at 21 C. The 1.5 x 2.1 m farrowing crates were installed over a woven wire floor. The rear 600 mm of the crate floor was made from flat iron slats. The farrowing crates were equipped with a heated front creep which was maintained at 25 C with heat provided from hot water pipes located in the cement floor. Heat lamps were also provided for the first week post-partum. The farrowing crates were cleaned twice daily. Sows were fed ad libitum the same ration as they received during gestation. In addition, the ration was top dressed, twice daily, with 500 g of a high fat supplement.

Piglets were individually weighed within 24 hr of birth and at weaning (average weaning age 26 days). Routine herd management procedures were followed including clipping of teeth and tails and ear notching at day one, administration of iron injections and castration at day three and antibiotic treatment as necessary. Fresh creep feed and water were provided ad libitum after the piglets reached 10 days of age. The creep feed contained 18% crude protein and was formulated to meet or exceed NRC recommendations for all other nutrients.

Records were kept of the number of pigs born alive, born dead, and weaned. Birth weight and weaning weight were also recorded. In addition, mortality from birth to weaning was tabulated and the cause of death determined wherever possible. Stillbirths were confirmed by removing the lungs and inserting them into water to determine if they would float.

RESULTS AND DISCUSSION

Piglets farrowed in crates fitted with a Blowaway unit moved to the creep area whenever the Blowaway unit was activated. Even after the Blowaway unit was removed, the piglets continued to move away from the sow's body whenever she stood. This greatly reduced their chances of being crushed and sows farrowing in crates fitted with a Blowaway unit crushed approximately half the number of piglets as sows farrowing in crates without a Blowaway unit (Table 2). However, mortality as a result of starvation, genetic defects and other miscellaneous causes was higher in crates equipped with a Blowaway unit so that the total number of piglets dying was similar for both treatments (95 vs 89).

Control sows farrowed an average of 11.3 pigs per litter while those on the Blowaway treatment farrowed an average of 11.4 pigs per litter (Table 3). The average birthweight of piglets for both treatments was 1.4 kg. Sows farrowing in crates fitted with a Blowaway unit weaned an average of 0.2 more pigs per litter than sows farrowing in crates without a Blowaway unit. The

average weaning weight was 7.4 kg for control sows and 7.3 kg for sows farrowing with a Blowaway unit. Preweaning mortality averaged 15.3% for control sows and 12.4% for sows farrowing in crates fitted with a Blowaway unit. None of these differences were statistically significant.

CONCLUSIONS AND IMPACT

This experiment was conducted under excellent management and environmental conditions with the result that even the control sows had a preweaning mortality significantly below that obtained on most commercial units. With a poorer environment and a lower level of management, it is possible that more pigs would be saved as a result of using the Blowaway attachment. However, under the conditions of this experiment, no beneficial effects were observed.

Table 1. Formulation of Gestation-Lactation Diet

Barley	75.0%
Soybean meal (46.5%)	7.0%
Canola meal (35.0%)	14.0%
Dicalcium phosphate	1.4%
Limestone	1.6%
Salt	0.4%
Tallow	0.1%
Vitamin-mineral premix[1]	0.5%

[1]Supplied the following per kilogram of diet: 12,5000 IU vitamin A; 1,375 IU vitamin D; 32 IU vitamin E; 9.3 mg riboflavin; 23.8 mg pantothenic acid; 78.1 mg niacin; 306.2 mg choline; 27.5 ug vitamin B_{12}; 2,8 mg pyrodoxine; 0.1 mg biotin; 0.8 mg thiamine; 0.6 mg folic acid; 2.7 mg menadione; 109.9 mg endoxin; 0.5 mg iodine; 13.7 mg copper; 187 mg iron; 55 mg manganese; 125 mg zinc; 0.1 mg cobalt; 0.1 mg selenium.

Table 2. Causes of Pre-Weaning Mortality (%)

	Control	Blowaway
Stillbirths	33.7 (32)[1]	40.4 (36)
Laid On	22.2 (21)	10.2 (9)
Starvation	10.5 (10)	14.6 (13)
Genetic Defect	3.1 (3)	4.4 (4)
Born Weak	20.0 (19)	15.8 (14)
Mixcellaneous	10.5 (10)	14.6 (13)
	100.0 (95)	100.0 (89)

[1]Number in parentheses indicates actual number of pigs dead from cause.

Table 3. Effect of the Medata Blowaway System on Sow Performance

	Control	Blowaway	S.E.[1]
Number of Sows	35	34	
Average Sow Parity	4.4	5.0	0.51
Pigs Born Alive	11.3	11.4	0.43
Birth Weight (kg)	1.4	1.4	0.03
Pigs Weaned	9.5	9.7	0.30
Weaning Weight (kg)	7.4	7.3	0.18
Mortality (%)	15.3	12.4	2.47

[1]Standard Error of the Mean.

IMMUNIZATION OF SWINE AGAINST SOMATOSTATIN

B. Laarveld and P.A. Thacker

INTRODUCTION

Somatostatin is a peptide hormone consisting of 14 amino acids. It is secreted from the hypothalamus and has been shown to strongly inhibit growth hormone secretion from the pituitary gland. It is desirable to increase the rate of secretion of growth hormone from the pituitary gland because higher levels of growth hormone in the blood result in higher average daily gains, leaner carcasses and better feed efficiency in swine.

The objective of our on-going research is to develop a method which will neutralize somatostatin. This can be achieved by immunizing the animal against it own circulating somatostatin. The antibodies thus formed will neutralize the endogenous somatostatin, leading to increased levels of growth hormone in the blood.

The somatostatin vaccine by itself is weakly immunogenic and a strong immune response is required. Therefore adjuvants are included in the vaccine to help mount a vigorous immune response. Unfortunately, there is little information available as to which adjuvant is most appropriate.

OBJECTIVE

To compare the usefulness of four different adjuvants for use in the immunization of swine against somatostatin.

EXPERIMENTAL PLAN

Twenty weanling pigs (Yorkshire x Landrace) weighing 29 $\pm$ 1 kg were assigned to one of five treatments. The diet fed was barley-based with soybean meal used as the protein supplement. The pigs received a diet containing 16% crude protein until they reached 55 kg, at which time the protein content was reduced to 14%. All other nutrients were present in sufficient amounts to meet or exceed requirements.

The pigs were housed four to a pen (two barrows and two gilts) in concrete floored pens measuring 2.7 x 3.6 m. The pigs were allowed access to a self-feeder for 30 minutes, three times a day until they reached a weight of 45 kg. Thereafter, only twice a day access was allowed. Water was available ad libitum throughout the experiment.

All pigs receiving the somatostatin immunization treatment were immunized with the same somatostatin-ovalbumin conjugate (50 ug somatostatin equivalent) whereas the pigs in the control treatment received ovalbumin carrier only (200

Treatments were:

a. Control - ovalbumin with the adjuvant Havlogen.
b. Somatostatin immunization with the adjuvant Havlogen.
c. Somatostatin immunization with Freunds Complete Adjuvant for the primary immunization and Freunds Incomplete Adjuvant for the booster immunization.
d. Somatostatin immunization with the Ribi Adjuvant System consisting of Trehalose Dimycolate and Monophosphoryl Lipid A.
e. Somatostatin immunization with Regressin (bacterial cell wall constituent).

All adjuvants were used following the recommendations of the manufacturers. Freunds Adjuvant was used as a positive control. The pigs were vaccinated at a weight at 30 kg and boosted after two weeks. Blood samples were taken every two weeks.

RESULTS AND DISCUSSION

The antibody titers against somatostatin present at 24 and 50 days after the first injection are presented in Table 1. No antibody titers were detectable in pigs receiving the control treatment. Freunds Complete Adjuvant induced a very strong immune response, whereas the Havlogen, Ribi and Regressin treatments resulted in relatively low titers. It is desireable to achieve a titer of 1:1000. Thus the Havlogen, Ribi and Regressin adjuvants were not unsuccessful in illiciting an adequate immune response. While the Freunds Adjuvant treatment did result in high titers, it cannot be used in food producing animals, because it produces a TB positive test in the carcass.

CONCLUSION

We conclude that the most important limitation to the use of somatostatin immunization is the lack of a suitable adjuvant. Further method development is required to improve the immune response to somatostatin immunization before the commercial application of somatostatin immunization in animal production can be evaluated.

IMPACT ON INDUSTRY

Successful conclusion of the development of a somatostatin vaccination technique may result in a new method of growth promotion for farm livestock.

Table 1. Somatostatin antibody titers[1] of pigs immunized with a somatostatin-ovalbumin conjugate with different adjuvants

	Control	Havlogen	FCA[2]	Ribi	Regressin
24 days post-injection					
pig 1	ND[3]	4	4000	ND	4
pig 2	ND	4	2500	ND	6
pig 3	ND	ND	2500	ND	3
pig 4	ND	7	5000	ND	2
50 days post-injection					
pig 1	ND	ND	2500	2	ND
pig 2	ND	ND	2500	ND	2
pig 3	ND	ND	5000	2	ND
pig 4	ND	4	5000	2	ND

1 Dilution of plasma required to achieve 50% binding of 5000 cpm of radioactive somatostatin in a final volume of 0.7 ml

2 Freunds Complete Adjuvant

3 Not detectable

C. PAPERS PREPARED AND TALKS GIVEN

P.A. Thacker, 1986. Use of the Medata Blowaway System in an Attempt to Reduce Preweaning Mortality in Baby Pigs. Farm Building Progress, 84: 13-15.

P.A. Thacker, 1987. Novel Approaches to Growth Promotion in the Pig. Alberta Pork Seminar, Banff, Alberta.

P.A. Thacker and E.M. Barber, 1987. Use of Planned Drafts in an Attempt to Reduce Preweaning Mortality in Baby Pigs. Can. J. Agr. Eng. (In Press).

Agricultural Development Fund

Project # R-86-01-0067

"Improvement of Sow Fertility"

Personnel Distribution Listing

		%
R.J. Kirkwood	Research Associate	100
D.A. Gillis	Technician	100
F. Savage-Oliver	Animal Health Technician	80
P. Gnanapragasm	Student Assistant	25
A. Gooneratne	Postdoctoral Fellow	10
R. Hermann	Stockman	80

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#R-86-01-0067

UNIVERSITY OF SASKATCHEWAN
Saskatchewan Agriculture
"Improvement of Sow Fertility Project"
Under the Direction of D.A. Christensen, Animal & Poultry Science
Statement of Receipts & Expenditures for the Period
July 16, 1986 - February 28, 1987

Receipts

Saskatchewan Agriculture - August 1986		$63,000

Expenditures

Salaries	$8,748	
Fringe Benefits	465	
Materials & Supplies	4,945	
Travel	89	14,247

Unexpended Balance as of February 28, 1987	$48,753

PROJECT DIRECTOR

(Ms.) C.M. BOYER
RESEARCH ACCOUNTANT

Agricultural Development Fund

Project #R-86-01-0067

"Improvement of Sow Fertility"

Financial Projection to March 31, 1987

Salaries and Benefits	$57,000
Materials and supplies, including sow maintenance costs	14,000
Equipment - 86/87 rental charges for gamma counter	4,211
	$75,211